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ABSTRACT

To what degree do teacher participants in one science enhancement institute intend to use the information in the classroom the next fall? What factors assist this extension of learning? What factors detract from teachers applying new knowledge in the classroom? Sixteen second- to eighth-grade science teachers from a physical and life science enhancement summer institute participated in a baseline study to apply the social science "Theory of Planned Behavior" to an educational setting. The study centered on the teachers' intentions to use the knowledge gained from the institute in their classrooms. The goal behavior for the participants was to teach two investigations from the institute in the classroom before October 14, 1989. Using tenets of the Theory of Planned Behavior, an open-ended questionnaire identified participants' salient beliefs relating to personal outcomes, personal support, and personal control. Results of the open-ended questionnaire were content analyzed and rewritten to reflect the participants' belief statements. Closed questionnaires were developed to learn more about teachers' intentions to use their investigations in their classrooms. (Author/KR)

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Intentions of Grade 2-8 Science Teachers to Use Science Investigations: Application of the Theory of Planned Behavior

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Abstract

To what degree do teacher participants in one science enhancement institute intend to use the information in the classroom the next fall? What factors assist this extension of learning? What factors detract from teachers applying new knowledge in the classroom? Sixteen 2nd-8th grade South Dakota science teachers from a physical and life science enhancement summer institute participated in a base-line study to apply the social science "Theory of Planned Behavior" to an educational setting. The study centered on the teachers' intentions to use the knowledge gained from the institute in their 2nd-8th classrooms. Earlier applications of this theory to education by Crawley indicated that the intention to perform a specific behavior was within the control of teachers, and that teachers in his

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research needed little social support as long as there were resources and sufficient opportunity to perform the behavior.

The goal behavior for the participants was to "teach two investigations from the institute in the classroom before October 14th, 1989." Using tenants of the Theory of Planned Behavior, an open-ended questionnaire identified participants salient beliefs relating to personal outcomes, personal support, and personal control.

Results of the open-ended questionnaire were content analyzed and rewritten to reflect the participants' belief statements. Closed questionnaires were developed to learn more about teachers' intentions to use their investigations in their classrooms. Regression analyses were employed. Qualitative data, including personal interviews and a demographic survey enriched the results of the closed questionnaires. Gains in participants' science content knowledge was statistically significant, and overall science attitude of participants was high, according to the "Attitudes, Preferences and Understanding Survey" administered to the participants. The Theory of Planned Behavior was shown to have utility in identifying the intentions of teachers to use inservice information toward improving classroom practices in this base-line study with a limited number of subjects.

Intentions of Grade 2-8 Science Teachers to Use Science Investigations: Application of the Theory of Planned Behavior

Purpose of the Study

The purpose of this base-line study was to apply the Theory of Planned Behavior to the intentions of sixteen 2nd-8th grade science teachers to determine the factors that influence the teacher's willingness to use the information gained in a summer science institute in their classrooms. By enriching the quantitative data with descriptive data, and by examining the intentions of the teachers to apply information from the institute, the factors that support the application of knowledge from the institute in the classroom will be clarified.

Significance

The Theory of Planned Behavior as described in Understanding Attitudes and Predicting Social Behavior (1980) by Ajzen and Fishbein states that the reason for behavior can be explained by a person's intention. Intention, according to this theory, is influenced by attitude toward the behavior and perceived social pressures. In a paper presented at the 1989 NARST Annual Meeting, Crawley explored the utility of the Theory of Planned Behavior, found in social science research. He used the theory for predicting behavioral intentions of teachers enrolled in a science institute to use activities and investigations during the next school year. Crawley found that attitude, subjective norm, and perceived behavioral control contributed significantly to predicting behavioral intention. Attitude toward behavior was found to be the most important predictor of behavioral intention in his study. He postulated that intention to perform the behavior was within the

control of teachers, and that teachers in the study needed little social support as long as there were resources and sufficient opportunity to perform the behavior.

Attitude researchers are aware that underprepared science teachers are reluctant to teach science. The factors that influence attitude toward science teaching include science knowledge (Shrigley, 1974), understanding of process skills (Riley & Schaffer, 1979), locus of control (Haury, 1989), and many other factors that directly or indirectly affect teachers science attitudes. More clarification of the interaction between the variables affecting teachers' attitudes is needed (Morrisey, 1981).

Ultimately, defining and comparing the influence of the factors that contribute to inservice teachers' application of knowledge in the classroom can contribute to improved inservice designs and enhance more research-based classroom practices.

Design and Procedures

Subjects and the Setting

In this base-line study were sixteen grade 2-8 science teachers who participated in the summer institute, "Can We Save This Fragile Earth?" The June, 1989, intense two week institute was funded by Title 11, Education for Economic Security Act and was awarded by the South Dakota Board of Regents to Sioux Falls College. A follow-up session for participants to share results of classroom application of the institute was held in October, 1989. Site visits to teacher's classrooms enhanced the data.

The physical and life science institute which provided the vehicle for improved science teaching emphasized improved understanding of science

content, enhanced positive attitudes toward science, the application of science in everyday life, and encouragement for participants to teach more investigative lab sessions than were previously taught. During the two weeks, lecture discussions were followed by laboratory investigations for reinforcement of each topic. A field trip illustrated the application of the topic in the region. Professors became science resource persons as the teachers led brainstorm sessions to initiate their development of investigations that used the topic principles. A handbook of investigations was developed, and a poster session by teachers to demonstrate favorite investigations was held the last day of the institute.

Collaboration between teachers, administrators, and the college resulted in the framework for the institute. The objectives of the South Dakota Science Curriculum, the results of teachers' needs assessments, and changing teachers' recertification requirements were considered by the multi-disciplined science professors as they developed their topics around the project theme. The teachers who were selected for the institute were nominated by their principals as effective teachers. Participating teachers were predominantly from schools in small communities, with 2 teachers from towns and 1 from a city. Only one had the assistance of a science resource specialist. Most of the project teachers taught in self-contained classrooms. Science was the favorite subject of only two of the teachers.

Questions For the Study

In this base-line study, determining the intentions of the sixteen institute participants and better understanding the factors that contributed to and impeded their application of knowledge obtained in the project was examined in light of the following questions:

1. Did the teachers learn science?
2. Did the teachers intend to use science knowledge from the institute?
3. Did the teachers use the institute material to improve classroom instruction by teaching the investigations?

Procedures

Intention was addressed using the Theory of Planned Behavior by Ajzen and Fishbein, who outlined four phases of a study:

1. Identify the target behavior of interest.
2. Develop and administer an open-ended questionnaire to identify salient beliefs.
3. Design the closed questionnaire which incorporated participant generated beliefs.
4. Administer the closed questionnaire and analyze results.

The target behavior for participants was to "teach two science investigations developed in the institute in the classroom before October 8th, 1989." The target behavior used these necessary components of the Theory of Planned Behavior: action, target, context, and time:

> Teach (action) 2 science investigations (target) developed in the institute in your classroom (context) before October 14th, 1989 (time).

The open-ended questionnaire to identify participants salient beliefs was modified from a questionnaire developed by Crawley in his work with physical science teachers (Crawley, in press). Questions were related to personal outcomes, personal support, and personal control. Participants were encouraged to freely express their views. The questionnaire was administered the first day of the institute.

Results of the open-ended questionnaire were content analyzed. All statements were collected, rewritten, and reduced to the minimum number that include at least 90% of the beliefs stated on the open-ended questionnaires. The wording was adjusted so that in the revised belief statements, the teachers could recognize their beliefs as being encompassed by the newly worded statements.

Closed questionnaires were administered to the participants the last day of the institute. The intention statement, i.e., that teachers teach 2 science investigations from the institute in their classrooms before October 14, 1989 was clear to the participants. Additionally, the participants were aware of the expectation of this follow-up activity as a prerequisite for participation in the institute.

For determining science background understanding gained in the institute, teachers were administered instructor prepared pre- and post-short answer tests. Both tests were graded by the external evaluator.

Science attitudes of project teachers were assessed by the "Attitudes, Preferences, and Understanding: Teacher Version" by W.F. McComas, from the Iowa Assessment For Evaluation, University of Iowa Science Center. Demographic data was also obtained through participant surveys.

Process and end evaluations by project teachers provided feedback to the independent evaluator in the project. Qualitative data from participants included individual and group interviews, and video tape of site visits. Project products included a handbook of the investigations developed by the teachers, a poster session to demonstrate the investigations, a "teacher share" follow-up event, and evidence of integration of the investigations into the classroom science curriculum.

Data Analysis

The data from the closed questionnaire, attitude survey, and demographic survey were analyzed with SPSS on the VAX/VMS university computer. In the closed questionnaire, a reliability of .7997 resulted from positively stated items, using Cronbach's alpha. Kendall's b Correlation was employed to determine relationships between pairs of variables with significance less than the .05 level. Frequencies of the demographic data were tabulated using SAS on the VAX/VMS. Qualitative results of the interviews were used to enrich the quantitative data.

Findings

Did the teachers learn science in the institute? An independent evaluator administered the pre- and post-tests to institute participants. The test consisted of 30 objective items, either identical or in parallel form to the items in the pretest. The group averaged 57 percent competency on the pre-test and 73 percent competency on the post-test. The difference between the mean scores of the pre- and post-test for science content knowledge was statistically significant. Teachers were observed as they presented demonstrations of investigations that they had developed from the principles in the institute. The handbook of investigations which had two contributions from each of the sixteen teachers showed the application of science content.

Did teachers intend to use information from the institute in the classroom? The goal of the institute was for teachers to teach two of their developed investigations by October 14, 1989. In the Theory of Planned Behavior by Ajzen and Fishbein, little social support is needed to accomplish the goal, as long as resources and opportunities to accomplish behavior are available to the teacher. In the closed question survey conducted at the end of the institute, the following were rated on a 7 point scale:

7 teachers expressed highest desire to complete the investigation teaching goal, while 5 others expressed high intentions.

3 teachers expressed no intention to complete the goal.

All sixteen rated the institute as worthwhile by indicating that they "would recommend this institute to other teachers".

Did the teachers use the institute material to improve classroom instruction by teaching more investigations? According to the demographic survey, 84% of the teachers viewed themselves as reasonably qualified to teach science. Only 25% expressed the need for more science background, while 67% wanted to learn new science teaching methods. In fact, 66% used lecture/discussion daily as the most popular teaching approach, while less than 9% used hands-on investigations at least weekly in their science classrooms. Fourteen of the participants thought that science courses for teachers (such as the institute) were useful for improving future teaching. Fourteen of the participants rated "being curious and exploring" or "thinking through problems" as highest goals of science, which complemented the investigative nature of the institute. Although only 2 of the sixteen participants thought that science as their most favorite subject to teach, The independent evaluator, who reviewed process and final participant

evaluations stated that "without exception, the responses indicated that each of the participants came to the two-week experience with a very positive attitude about science and about teaching science"

From the site visits made to the teachers' classrooms, three of the sixteen teachers said that they had, in fact, taught 2 investigations from the handbook by the target date. Five teachers indicated other utility of the institute than completing the stated goal. Five "planned to do an investigation soon."

Implications for Science Teaching

The Theory of Planned Behavior was shown to have utility in the identification of intentions of teachers to utilize inservice information in the classroom. Although the teachers in this base-line study of limited size had high intentions to apply the science background from the institute in the classroom, only 3 of the sixteen teachers did reach that goal. Teachers in the project had positive attitudes about science and science teaching, yet only three of the teachers met the project goal. According the cognitive test results, the teachers had learned from the project, yet only three used the institute information and taught the 2 investigations in the classroom.

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Table 1
External Sources of Support

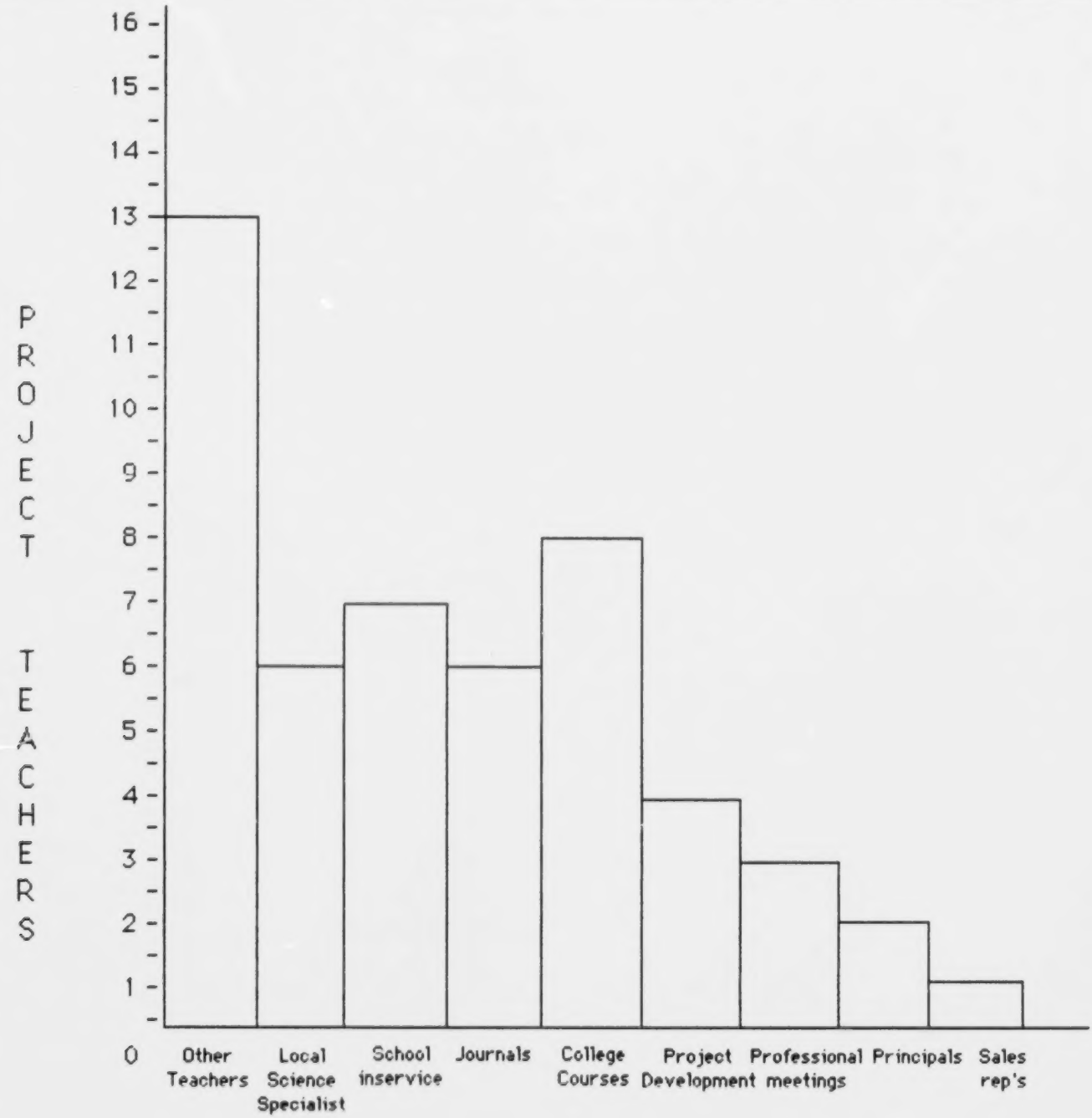


Table 2
Kendall Correlation Coefficients and Significance Level Matrix

	goal will make chg+	Feedback+	share ideas+	curriculum fit-	enough time-	plan/prep-
Feedback+	.4294 (.029)*					
Share ideas+	.1039 (.320)	.2877 (.107)				
Curriculum fit-	.2327 (.157)	-.2212 (.178)	-.1103 (.319)			
Enough time-	-.3958 (.034)*	.0121 (.479)	-.0938 (.337)	-.1951 (.199)		
Plan/prep.-	.1789 (.204)	-.2385 (.145)	-.2424 (.137)	.3212 (.082)	-.0321 (.441)	
Enrich kids+	.5850 (.005)*	.4939 (.017)	.2767 (.114)	.0690 (.386)	-.3963 (.039)*	-.3212 (.076)
Personal enrich+	.5532 (.006)*	.4513 (.025)*	.3640 (.054)*	1757 (.227)	- 4272 (.027)*	-.1770 (.212)
Principal support+	.6097 (.003)*	.2182 (.169)	.4105 (.033)*	.1309 (.286)	-.4891 (.013)*	.0321 (.441)
Personal support+	.6364 (.003)*	.4762 (.022)*	.3160 (.087)	2737 (.128)	-.2563 (.131)	-.0961 (.336)
Peer support+	.3698 (.046)*	-.0616 (.394)	-.4651 (.019)*	.1611 (.245)	-.2431 (.134)	.1414 (.259)
Getting materials-	.2114 (.168)	.2522 (.135)	-.4149 (.032)*	-.0934 (.344)	.1583 (.236)	-.0779 (.361)
Personal benefit+	.0561 (.401)	.4186 (.036)*	.2455 (.142)	-.0272 (.454)	.1479 (.255)	-.5149 (.011)*
Intention to meet goal+	.0870 (.346)	.2218 (.166)	.5128 (.011)*	-.3292 (.078)*	-.1989 (.183)	-.1196 (.292)

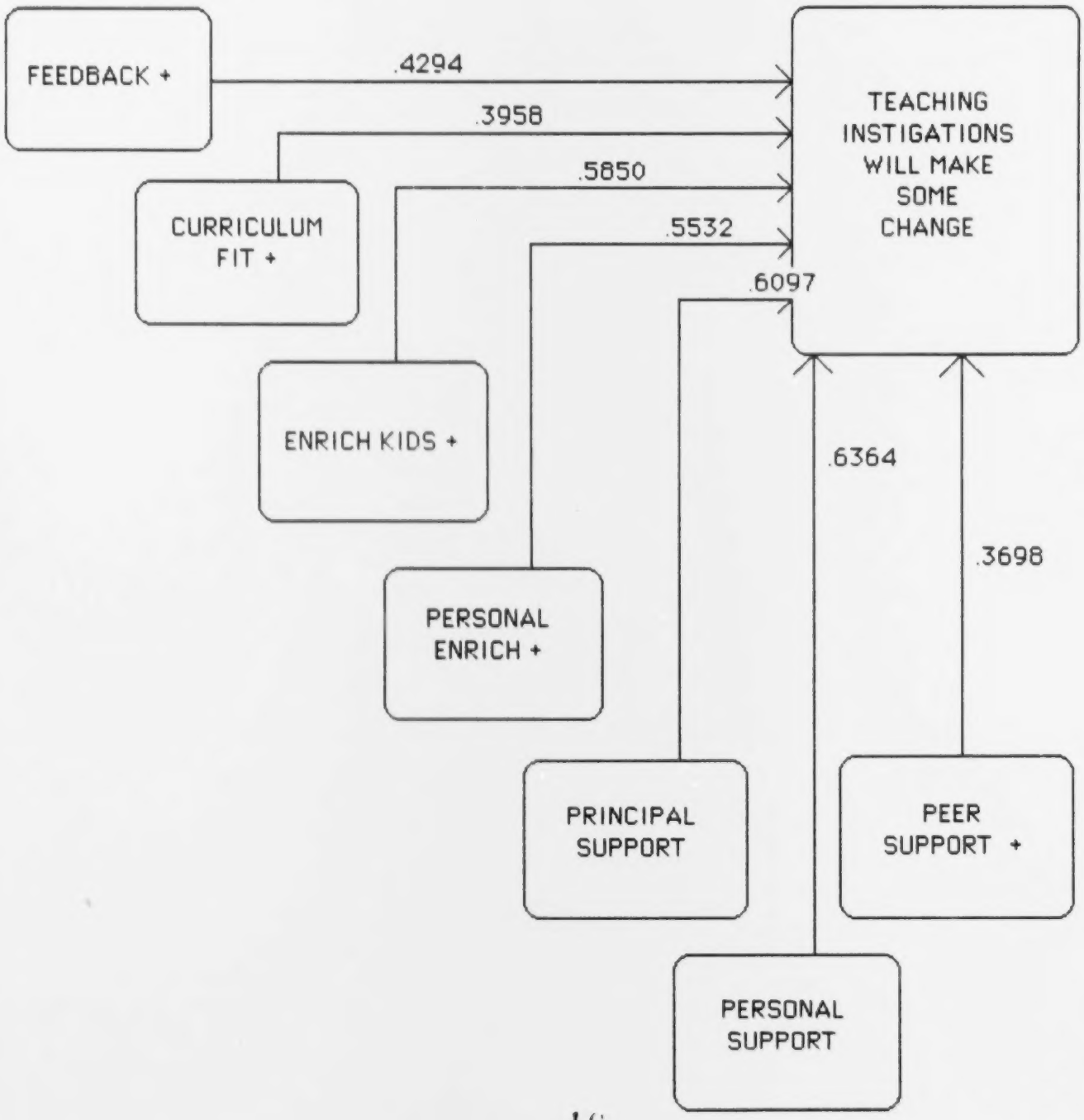
Sig = ≤ .05, n=16

Table 2
Kendall Correlation Coefficients and Significance Level Matrix

	enrich kids+	personal + enrichment	principal support+	personal support+	peer support+
Personal enrich+	.7354 (.001)				
Principal support+	.4779 (.017)*	.5621 (.006)*			
Personal support+	.7066 (.001)*	.6941 (.001)*	.4271 (.031)*		
Peer support+	.3674 (.053)*	.0800 (.360)	.0111 (.480)	.2109 (.179)	
Getting materials	.1576 (.244)	.0000 (.500)	-.2149 (.165)	.0000 (.500)	.6094 (.003)*
Personal benefit+	.4880 (.018)*	.5412 (.009)*	.0910 (.343)	.4342 (.032)*	-.1157 (.304)
Intention to meet goal+	.4622 (.021)*	.4229 (.029)*	.3205 (.073)	.2605 (.128)	-.1236 (.288)

Sig = ≤ .05
n=16

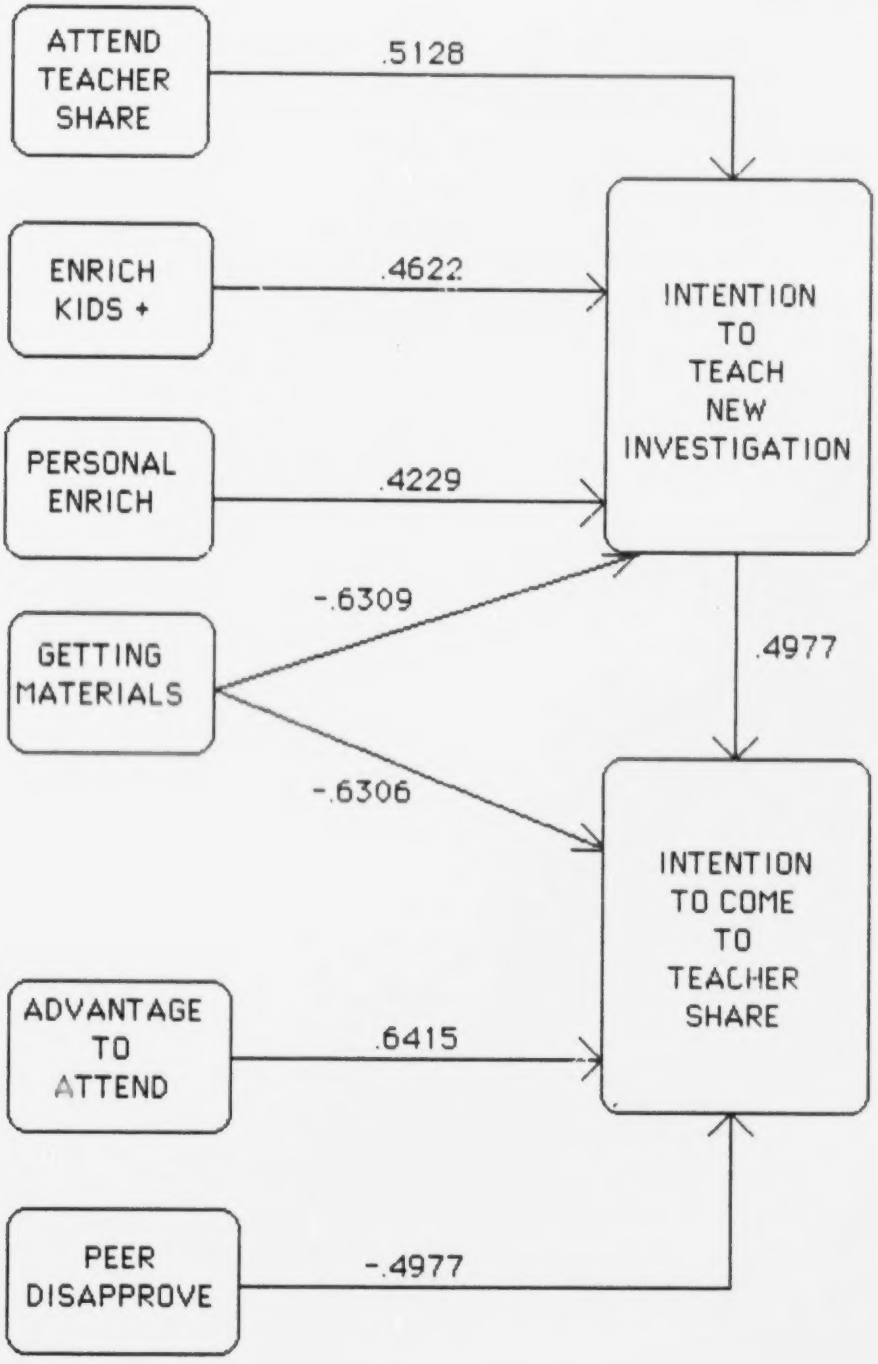
Figure 1
Association Between Teachers' statements and Change



Kendall Correlation Coefficients

Figure 2

Association Between Teachers Statements and Intention to Change



Kendall Correlation Coefficients